Express Mail Certificate: EV 368751788 US
Date Mailed: December 16, 2003

UNITED STATES PATENT APPLICATION FOR GRANT OF LETTERS PATENT

GERALD P. MICHALAK
INVENTOR

INTEGRATED WIRELESS HEADSET

COATS & BENNETT, P.L.L.C.
1400 Crescent Green, Suite 300
Cary, North Carolina 27511
(919) 854-1844

INTEGRATED WIRELESS HEADSET

BACKGROUND OF THE INVENTION

The present invention relates generally to wireless mobile devices, and more particularly to a wireless headset integrated with a mobile device.

The popularity of mobile devices, such as cellular telephones, personal data assistants (PDAs), etc., continues to increase each year. To maintain this trend, manufacturers continue to explore ways to make mobile devices appeal to a larger percentage of the population. One area of focus involves hands-free wireless communication where wireless headsets communicate with a local mobile device via a local wireless network.

Because wireless headsets free-up a user's hands while the user communicates with friends, family, and colleagues using their mobile device, users are free to perform other tasks, such as driving, shopping, etc. As a result, wireless headsets increase the convenience of using a mobile device. However, because conventional wireless headsets are separate from mobile devices, a user has to separately track and carry the wireless headset. Further, users typically have to separately monitor the headset battery and charge the wireless headset battery on special headset chargers, which may be separate from the mobile device charger. To many users, the inconvenience of having to separately maintain and track the wireless headset outweighs the convenience associated with using the wireless headset.

SUMMARY OF THE INVENTION

The present invention comprises a method and apparatus that integrates a wireless headset with a mobile terminal. In an exemplary embodiment, the housing of the mobile terminal includes a fastener for mechanically connecting the wireless headset to the housing. When the wireless headset is mechanically connected to the

housing, the wireless headset interfaces with the mobile terminal via an electrical interface. Alternatively, when the wireless headset is mechanically disconnected from the housing, the wireless headset interfaces with the mobile terminal via a wireless interface.

In exemplary embodiments, the speaker and microphone associated with the wireless headset also operate as the mobile terminal speaker and microphone. Thus, when the wireless headset is mechanically connected to the mobile terminal, the speaker and microphone of the wireless headset interface with the mobile terminal via an electrical interface and operate as a conventional speaker and microphone for the mobile terminal. However, when the wireless headset is mechanically disconnected from the mobile terminal, the speaker and microphone are also mechanically disconnected from the mobile terminal. As a result, the speaker and microphone interface with the mobile terminal via a wireless interface.

Exemplary embodiments of the present invention may also include a detector circuit to determine the position of the wireless headset relative to the mobile terminal. The mobile device then automatically selects an operating mode based on the determined position. For example, if the detector circuit determines that the wireless headset is mechanically disconnected from the mobile terminal, the mobile terminal may automatically select a wireless-interface operating mode and establish a wireless interface between the wireless headset and the mobile terminal. Alternatively, if the detector circuit determines that the wireless headset is mechanically connected to the mobile terminal, the mobile terminal may automatically select an electrical-interface operating mode, and establish an electrical interface between the wireless headset and the mobile terminal.

BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1A – 1C illustrate a series of schematic views of an exemplary mobile device and wireless headset according to the present invention.

FIG. 2 illustrates a block diagram of an exemplary mobile device and wireless headset operating in an electrical-interface operating mode according to the present invention.

FIG. 3 illustrates a block diagram of an exemplary mobile device and wireless headset operating in a wireless-interface operating mode according to the present invention.

FIG. 4 illustrates an exemplary method of determining the position of the wireless headset relative to the mobile device.

DETAILED DESCRIPTION OF THE INVENTION

The following describes a cellular telephone with an integrated wireless headset that operates in one of two operating modes. In a first operating mode, the wireless headset is mechanically and electrically connected to the cellular telephone such that the speaker and microphone of the wireless headset operate as the speaker and microphone of the cellular telephone. In the second operating mode, the wireless headset is mechanically and electrically disconnected from the cellular telephone. In this mode, the speaker and microphone of the wireless headset interface with the cellular telephone via a wireless interface.

Figures 1A – 1C illustrate an exemplary mobile device 100 comprising a cellular telephone 105 and a wireless headset 120 according to the present invention. While the present invention is described in terms of a cellular telephone, those skilled in the art will appreciate that the present invention is applicable to any mobile device, including a clamshell cellular telephone, a Personal Communication System (PCS), a Personal Digital Assistant (PDA), a conventional laptop and/or

palmtop receiver, or any other mobile device that includes a radiotelephone transceiver.

Mobile device 100 includes a cellular telephone 105 with an associated housing 110 and a wireless headset 120. Housing 110 encases the electrical components of the cellular telephone 105 and typically includes user interface components, such as a display 112, keypad 114, and/or control buttons 116 disposed on the outer surface of housing 110. A user interfaces with the cellular telephone 105 according to any conventional method. For example, the user may interface with cellular telephone 105 via the user interface components, as known in the art. Alternatively, cellular telephone 105 may include voice recognition capabilities that allow the user to interface with cellular telephone 105 using voice commands.

Wireless headset 120 is a hands-free communication device that enables a user to communicate with the cellular telephone 105 using a local wireless interface. In exemplary embodiments, the local wireless interface comprises a short-range *ad hoc* wireless network, such as a Bluetooth® network. A Bluetooth® network is a universal radio interface that enables two or more wireless devices to communicate wirelessly via short-range *ad hoc* networks. For further details regarding Bluetooth® technology, the interested reader may refer to "Bluetooth – The universal radio interface for ad hoc, wireless connectivity," presented by Jaap Haartsen in Ericsson Review No. 3, 1998, which is herein incorporated by reference. While the present application refers to a short-range *ad hoc* wireless network as a "Bluetooth® network," those skilled in the art will appreciate that the present invention is not limited to Bluetooth® networks and is applicable to any wireless interface between a cellular telephone 105 and a wireless headset 120.

Wireless headset 120 generally includes a speaker 122 for projecting audible signals to a user, a microphone 124 for receiving audible signals from a user, and a

support for securing the wireless headset 120 to the head of a user, such as an ear support 126. Further, wireless headset 120 may include a pivot connector 129 that pivotally connects the ear support 126 to the microphone 124, and enables the user to position the microphone 124 at any desired location relative to the ear support 126 by rotating the microphone 124 about pivot connector 129.

Pivot connector 129 also enables the wireless headset 120 to be positioned into a compact arrangement that can be integrated and stored with cellular telephone 105 using a fastener. The fastener may be any fastening means known in the art, including straps, brackets, clips, etc., that secures the wireless headset 120 to the housing 110. In an exemplary embodiment, the fastener is a recess 130 disposed in housing 110, as shown in Figure 1C. Recess 130 is generally designed to secure the wireless headset 120 to housing 110. In one exemplary embodiment, recess 130 may frictionally hold the wireless headset 120 to the housing 110. Alternatively, in another exemplary embodiment, recess 130 may include a latch, such as a magnetic latch, a spring clip, etc., that holds wireless headset 120 within the recess 130. In any event, the user may secure the wireless headset 120 to the housing 110 by pushing the wireless headset 120 into the recess. When the user is ready to use wireless headset 120, the user may remove the wireless headset 120 from the recess 130 by pulling on the wireless headset 120 or by pressing a release button (not shown) disposed on the housing 110 to release the wireless headset 120 from the recess 130.

Recess 130 includes a speaker area 132 adapted to receive speaker 122, a microphone area 134 adapted to receive microphone 124, and an ear support area 136 adapted to receive ear support 126. In exemplary embodiments, the shapes of the speaker, microphone, and ear support areas 132, 134, 136 complement the shapes of the speaker 122, microphone 124, and ear support 126, respectively.

Further, the depth of recess 130 may be structured such that the wireless headset 120 is flush with the housing 110 when secured within the recess 130.

As shown in Figure 1C, recess 130 is positioned generally on a back of housing 110. Those skilled in the art, however, will appreciate that the recess 130 is not limited to this configuration, and may be formed on any portion of the housing 110 as appropriate for a given wireless headset 120 and cellular telephone 105. In the embodiment of Figure 1C, microphone area 134 is generally positioned proximate a side and/or bottom of housing 110, while speaker area 132 is generally positioned proximate the top of housing 110. Further, microphone area 134 may include an additional cutout section in a side of the housing 110 that positions the microphone 124 proximate the front of the housing 110 when wireless headset 120 is secured within the recess 130. The microphone cutout section may extend to the front of the housing 110, as shown in Figures 1A and 1C. Alternatively, the microphone cutout section may only extend through a portion of the side of the housing 110. Speaker area 132 may also include an additional cutout section in the top of housing 110 that enables speaker 122 to extend to the front of the housing 110 when wireless headset 120 is secured within the recess 130. As a result, when wireless headset 120 is secured within recess 130, the speaker 122 and microphone 124 are positioned proximate the locations conventionally reserved for the speaker and microphone of a conventional cellular telephone 105. Therefore, in addition to functioning as the primary speaker and microphone for the wireless headset 120, speaker 122 and microphone 124 also function as the primary speaker and microphone for the cellular telephone 105 when the wireless headset 120 is secured to the housing 110.

To facilitate using the speaker 122 and microphone 124 as the speaker and microphone of cellular telephone 105, cellular telephone 105 also includes electrical interface means, such as a connector or electrical contact, to electrically interface the

wireless headset 120 with the cellular telephone 105 when the wireless headset 120 is mechanically secured to the housing 110. In an exemplary embodiment, the electrical interface includes an electrical contact 138 disposed on a surface of the recess 130 that mates with a corresponding electrical contact 128 disposed on wireless headset 120. Accordingly, when wireless headset 120 is secured within recess 130, electrical contacts 128, 138 electrically connect the wireless headset 120 to the cellular telephone 105. While Figure 1C only shows one electrical contact 128, 138, those skilled in the art will appreciate that more than one electrical contact 128 may electrically connect wireless headset 120 to cellular telephone 105.

Referring now to Figures 2-4, operational details of the present invention will be described further. Figures 2 and 3 illustrate a block diagram of an exemplary mobile device 100. To facilitate the following discussions, each illustrated component of mobile device 100 is shown as a separate element. However, those skilled in the art will appreciate that two or more of these components may be combined into a single microprocessor, application specific integrated circuit, or other suitable circuit.

Mobile device 100 includes headset electronics 210 associated with wireless headset 120 and mobile device electronics 230 associated with cellular telephone 105. Headset electronics 210 include a headset controller 214 for controlling the headset electronics 210 and a headset battery 216 for providing power to the headset electronics 210. Headset electronics 210 further include speaker 122 for projecting audible signals to a user, microphone 124 for receiving audible signals from the user, and an audio processor 212. Audio processor 212 processes audio signals received from the mobile device electronics 230 according to known methods, and provides the processed audio signals to speaker 122 for projection to the user. Audio processor 212 further processes audible signals received by microphone 124 according to known methods, and forwards the processed audio

signals to the mobile device electronics 230. As discussed further below, audio processor 212 transmits/receives audio signals to/from the mobile device electronics 230 via an electrical or wireless interface, depending on the current operating mode of the mobile device 100. To that end, headset electronics 210 further include a wireless transmitter, such as a Bluetooth® transceiver 218 and antenna 220 for communicating with the mobile device electronics 230 via the wireless interface according to instructions provided by headset controller 214.

Mobile device electronics 230 include a transceiver 232 for transmitting/receiving information signals to/from a base station via a cellular antenna 234. Transceiver 232 may operate according to any known standard, including GSM, TIA/EIA-136, cdmaOne, IS-95, cdma2000, UMTS, or Wideband CDMA.

Mobile device electronics 230 also includes a power management circuit 236, mobile battery 238, mobile controller 240, and local wireless transmitter, such as a Bluetooth® transceiver 242 and antenna 244. Power management circuit 236 monitors and regulates the power of the mobile battery 238 according to known power management techniques. For example, power management circuit 236 may monitor the power level of the mobile battery 238, regulate a power dissipation rate of the mobile battery 238, and/or regulate and control the charging process used to charge mobile battery 238. In addition to the conventional power management of mobile battery 238, power management circuit 236 may also manage the power of headset battery 216 when power management circuit 236 is electrically connected to the headset battery 216. For example, power management circuit 236 may charge headset battery 216 and/or provide power to the headset electronics 210 via the headset battery 216.

The operation of the power management circuit 236 and the operations of other components in the mobile device electronics 230 is controlled by mobile controller 240 according to known techniques. Mobile controller 240 may also control

the operating mode of the cellular telephone 105, and typically controls the operation of Bluetooth® transceiver 242 and antenna 244 based on the operating mode. For example, mobile controller 240 may enable an electrical-interface operating mode when there is an electrical connection between headset electronics 210 and mobile device electronics 230, i.e., when wireless headset 120 is mechanically connected to housing 110, as shown in Figure 1B and functionally represented by Figure 2. In the electrical-interface operating mode, mobile controller 240 disables the Bluetooth® transceiver 242 and antenna 244, and relies solely on the electrical connections made by electrical contacts 128, 138 to provide a communication path between mobile device electronics 230 and headset electronics 210.

However, when there is no electrical connection between headset electronics 210 and mobile device electronics 230, such as when the wireless headset 120 is mechanically disconnected from the housing 110, as shown in Figure 1C and functionally represented by Figure 3, mobile controller 240 may enable a wireless-interface operating mode. In the wireless-interface operating mode, mobile controller 240 enables the Bluetooth® transceiver 242 and antenna 244 to establish a wireless interface between the headset electronics 210 and the mobile device electronics 230 according to Bluetooth® protocols known in the art.

In addition to the above-described components, mobile device electronics 230 also includes a mode control, such as headset detector 246, that indicates a desired operating mode to the mobile controller 240. Headset detector 246 selects a desired operating mode, i.e., an electrical-interface or wireless-interface operating mode according to a mode-related user input. In some embodiments, headset detector 246 selects the operating mode based on a command entered via the user interface or the position of a switch disposed on the housing 110.

Alternatively, in a preferred embodiment of the present invention, headset detector 246 automatically selects the operating mode based on the user-selected

location of the wireless headset 120 relative to the cellular telephone 105. For example, headset detector 246 may select the operating mode based on whether or not the wireless headset 120 is mechanically connected to the housing. In exemplary embodiments of the present invention, headset detector 246 determines if the wireless headset 120 is mechanically connected to housing 110 by determining if an electrical connection exists between the headset electronics 210 and the mobile device electronics 230. For example, headset detector 246 may monitor an electrical trace in the mobile device electronics 230, such as trace 233, to determine if there is current flowing between the mobile device electronics 230 and the headset electronics 210. When an electrical current flow is detected, headset detector 246 determines that the headset electronics 210 are electrically connected to the mobile device electronics 230. Alternatively, headset detector 246 may monitor the power management circuit 236 to determine if the power management circuit 236 is providing electrical current to the headset electronics 210. In any event, when electrical current is flowing between the mobile device electronics 230 and headset electronics 210, headset detector 246 determines that the wireless headset 120 is mechanically connected to the housing 110, and selects the electrical-interface operating mode; when no electrical current flow is detected, headset detector 246 determines that the wireless headset is mechanically disconnected from the housing 110, and selects the wireless-interface operating mode.

In addition to headset detector 246, mobile device electronics 230 may also include an optional headset locator 248 operatively connected to a locator button 118 disposed on housing 110. In response to the user activating the locator button 118, headset locator 248 transmits a locator request signal to the wireless headset 120. Upon receipt of the locator request signal, wireless headset 120 projects a locator signal, such as a visible and/or audible signal from the wireless headset 120. The

user may then locate wireless headset 120 by seeing and/or hearing the locator signal projected from wireless headset 120.

Referring now to Figure 4, an exemplary method of headset detection and location will be described. Mobile device electronics 230 begin the headset detection loop (Block 300) at any appropriate time, i.e., when mobile device 100 powers up. Headset detector 246 then determines if the wireless headset 120 is mechanically connected to the housing 110 according to any of the methods described above (Block 302). If wireless headset 120 is mechanically connected to the housing 110, mobile device 100 operates in the electrical-interface operating mode (Block 304). However, if wireless headset 120 is mechanically disconnected from the housing 110, mobile device 100 operates in the wireless-interface operating mode and establishes the wireless interface between the mobile device electronics 230 and the headset electronics 210 (Block 306).

In some embodiments, the output of Block 306 may return to Block 302, where control of the headset detection loop is maintained in the headset detector 246, and the process of Blocks 302 – 306 is repeated. However, if mobile device electronics 230 includes a headset locator 248, the output of Block 306 may continue to Block 308, where control of the headset detection loop is transferred to headset locator 248. Headset locator 248 then determines if locator button 118 has been activated (Block 308). If locator button 118 has not been activated, control of the headset detection loop returns to the headset detector 246, and the process of Blocks 302 – 308 repeats. However, if locator button 118 has been activated, headset locator 248 triggers the locator signal (Block 310) before returning control of the headset detection loop to the headset detector 246, where the process of Blocks 302 – 308 repeats.

The above discloses a cellular telephone 105 with an integrated wireless headset 120. Because the wireless headset 120 may be electrically and

mechanically integrated with the cellular telephone 105, the present invention includes several benefits over conventional mobile device/wireless headset combinations. First, because the wireless headset 120 is integral with the housing 110 of the cellular telephone 105, wireless headset 120 is readily available anytime the user has their cellular telephone 105 with them. Further, because the headset electronics 210 are electrically connected to the mobile device electronics 230 when the wireless headset 120 is mechanically connected to the housing 110, the headset battery 216 may be charged at the same time as, and with the same charger as, the mobile battery 238. As a result, only one charger is required to charge the mobile and headset batteries 238, 216. In addition, in the embodiments where the headset detector 246 automatically determines the position of the wireless headset 120, a user can activate the wireless-interface mode simply by removing the wireless headset 120 from housing 110. As a result, the user does not have to track the operating mode of cellular telephone 105.

The present invention may, of course, be carried out in other ways than those specifically set forth herein without departing from essential characteristics of the invention. The present embodiments are to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.